

INTEGRATED WATER MANAGEMENT AND THE TREATMENT OF REGULATORY TAKINGS: THE CASE OF CANADA'S WATER ALLOCATION REFORM

Theodore M. Horbulyk*
The University of Calgary

INTRODUCTION

Many jurisdictions have attempted to reform the policies and rules by which surface water and groundwater are allocated, either in isolation or as part of an integrated watershed management initiative. Importantly, this includes the set of policy changes designed to establish the use of market-based instruments to replace command-and-control policy regimes. Where a set of proposed changes deviates significantly from prior practice, either on a one-time basis or through its operation over time, this can give rise to windfall gains or losses to landowners, to water users, and to related third parties. At issue in this paper is whether, and in what ways, a legislative or Constitutional requirement for public compensation of regulation-related capital losses would help or hinder the pursuit of economic efficiency.

This paper explores these questions by first indicating when water policy reform might give rise to a claim for compensation due to a taking. Then the paper provides a conceptual framework that characterizes the takings provision as a specific constraint on policy-makers' attempts to pursue economic efficiency through resource policy reform. Importantly, the constraint can be satisfied not only by providing monetary compensation, but by providing any of a series of related policy changes that both increase resource rents to landowners—providing compensation-in-kind—and increase the efficiency of resource use. These points are made by drawing on illustrative examples based on the current groundwater and surface water allocation policies of Alberta, Canada.

WILL WATER RE-ALLOCATION REPRESENT A TAKING?

The premise of this paper is that the social objective of regulatory reform in water allocation is primarily an efficiency objective, set against a trend of water quality deterioration and growing water shortages and misallocation. These changes are driven by economic growth, climatic change, and other factors. However, where a set of proposed regulatory or policy reforms deviates significantly from prior practice this can give rise to capital gains or losses to landowners, to water users, and to related third parties. Especially in jurisdictions that do not have well developed water markets and institutions, the effects of regulatory change

affecting water will be capitalized into the market value of the lands where the water could be used.

In the United States, regulation-related capital losses by landowners might represent "regulatory takings" and, if so, under the Fifth Amendment to the U.S. Constitution could require just compensation to injured landowners. To a lay observer, it appears as though the U.S. Supreme Court's application of the takings clause has become broader in recent years, where the Court's decisions have provided new insights on the issue of when a regulatory action might be considered a taking. Innes (1995) provides an economist's survey of recent Supreme Court decisions¹ and illustrates how the takings clause has been applied in each.

The courts might find certain types of changes in water law are *not* takings, and that there is no legal obligation that compensation be paid. This could arise if the purpose of the changes were the protection of a public resource (or prevention of a related nuisance); if the changes made were applicable to all properties that are similarly situated; if there were a clear connection (a so-called "essential nexus") between the regulatory changes and the intended resource protection; and, if there existed some "rough proportionality" between the private costs an individual landowner were asked to bear and the external or social costs that his or her unregulated actions would have generated (Innes, 1995).

Conversely, other types of water law changes might be found to be takings if they were not to satisfy all of these criteria, or if they were to deny uses of land and water that a land owner should reasonably have expected to pursue (Innes, 1995:5). For example, a regulatory change that was a thinly disguised attempt at rent or resource extraction for some unspecified public purpose could give rise to an "inverse condemnation" action; that is, to a claim for public compensation due to a regulatory taking.

It is not the purpose of this paper to interpret or to second guess the future actions of courts or law makers on the issue of when regulatory reform of water allocations would or would not represent a taking that gives rise to claims for public compensation. Let it suffice to acknowledge that in the current U.S. legal environment, some types of potential regulatory reform of water usage would *not* be exempted from legal challenge nor from

liability to pay such compensation. One might equally acknowledge that U.S. legislative proposals brought forward as part of the Republican "Contract with America" provide for mandatory compensation when federal government action reduces the value of real property by ten percent or more. The terms of such compensation are spelled out in recent legislation such as HR925, "Private Property Protection Act of 1995," (Shabman and White, 1995:10) and dozens of similar bills introduced in U.S. state legislatures.

The analysis of takings that follows may generalize to the case of Canada and other countries where no similar Constitutional provisions exist.² A relevant policy question in these jurisdictions is whether an analogous legislative or Constitutional requirement would promote or impair economic efficiency. Alternatively, one might ask what would be the net social benefit or costs of enacting such a provision.

AN ECONOMIC FRAMEWORK FOR WATER POLICY REFORM UNDER THE TAKINGS CLAUSE

The legal and economics literature on the topic of regulatory takings has established various economic arguments about how the presence of the takings clause influences the efficiency of resource usage. This paper will not restate or re-present those findings from first principles, but will focus on numerous aspects that most directly apply to the case of broadly based water policy reform, and will suggest how some of the generic arguments that have been developed would apply in this specific context.

In a very general framework, one might suppose that the public managers or custodians of surface and groundwater resources take as their objective the maximization of the gains to society (expressed as some appropriately discounted net present value) from all current and future uses of that resource, both private and public. Whereas the size and distribution of these gains will, in general, be important, the analysis presented here will focus on the former; that is, on the economic efficiency objectives associated with the resource use.

Ordinarily, the resource managers and political agents charged with this responsibility will pursue their objective by maintaining, on their books, some portfolio of legislation and regulations. These could include provisions for alternative resource allocation rules and institutional mechanisms, various forms of taxation, subsidization, public provision, enforcement, monitoring, and so on. Over time, the management strategy that is followed might require changes, in the small or in the large, to the regulatory framework, and sometimes these regulatory changes could give rise to a claim for compensation on the grounds that they represent a taking.

The Constitutional requirement for compensation provides one specific operational constraint, then, on the actions of the managers. That is, they are to maximize the social gains from current and future uses of—in this case—water resources, subject to the requirement that where their actions give rise to a taking they must pay just compensation. This type of constraint will add to the existing set of constraints under which either the managers or the politicians are operating. Other examples include various forms of annual budgetary or budget-balancing requirements, fiscal constraints within their agency, and other legislative and Constitutional restrictions on their actions. Thus, when a takings provision is viewed as yet another type of constraint on public policy, the provision may or may not turn out to be the binding or most restrictive one in a given situation.

The policy reforms that are constrained by the existence of a takings provision might cause increases or decreases in three distinct types of values related to the resource use in question: (i) the social net benefit (or broadly based gained to society including non-monetary effects) that will be of primary interest to policy makers; (ii) changes in private property values that would trigger liability for takings compensation; and, (iii) other effects on individual's economic well-being, including landowners, tenants, consumers, laborers and others. In general, the existence of a takings provision cannot ensure that the changes in these three types of values will be of the same magnitude or even in the same direction.

When one wishes to assess the effects of constraining resource policy makers, such as by the use of takings legislation, it is important to realize that the policy decisions taken are, in principle, motivated by social benefits from the use of watershed resources where these may differ from private or market values. A policy reform that provides many non-market benefits to society may or may not cause these social gains to be reflected in private property values. Indeed, the market values of private lands might rise or fall when some policy reform is undertaken. Whether a specific policy reform provides more benefits than costs to society as a whole will depend on such features as *potential* uses of water that it allows, and the *social* discount rate that is appropriate for comparing future policy benefits with short term costs of the policy.

One interpretation of the takings clause would be a requirement that the market's valuation of any individual's potential use of water and land resources after a policy change must meet or exceed its value before that change, or else a liability to compensate exists. When land markets are subject to any of a long list of sources of market failure, the changes in these private valuations will not necessarily be the same as the changes in the social values that motivated them. These private

land values might be described as the present value of the after-tax flow of private benefits that the (marginal) market investor could derive from each legal parcel of the individual's land, given access to the water allocations under a specific resource policy regime. That is, changes in land and water rights values are determined by how the marginal investor *could* use them, and not necessarily by how the current owner *does* use them.

Careful definition of any capital gains or losses due to a policy reform must distinguish, therefore, among changes in social values (which in aggregate will have motivated the reforms); changes in real estate market values (which define the magnitude of any compensation payable); and, changes in private valuations placed on the land in question by the current landowners. From an efficiency perspective, the latter are largely irrelevant for the formation of policy or compensation.³ "Just compensation" in this case will not necessarily reimburse individuals fully for changes in their personal or intrinsic valuations. Since takings compensation is directed at landowners, it cannot compensate, for example, long term tenants caught off guard by a sudden change in resource policy, nor can it compensate consumers and third parties who might bear some of the incidence of any cost increases, for example.

One might also note briefly some of the other established arguments about the efficiency effects of the takings provision as they would apply to the example of water policy reform. (See Blume and Rubinfeld (1987); Farber (1992); and Rose-Ackerman (1992); for an elaboration of the following three arguments and others). For example, absent such a provision, landowners may underinvest in land improvements due to their own fears, or those of capital markets, that land and investment values might subsequently fall due to an uncompensated regulatory taking of irrigation water. (Conversely, *with* a takings clause, some landowners might *overinvest* as viewed from a social perspective, even when they fully and correctly expect some impending regulatory taking to occur, since the individuals expect to be fully indemnified for all ensuing losses.)

Proposed reforms that would maximize broadly defined social welfare might not receive legislative approval in a direct or representative democracy whose decision rules are incapable of trading off the intensity of voters' preferences. Consider a case where the majority might lose a little in order that the minority would gain much more. With a Constitutional assurance of just compensation, the majority is more likely to allow a water reform policy with such a distributional profile to proceed.

Having viewed a number of potential efficiency effects of regulatory takings in the large, it may now prove

instructive to examine a number of specific and related efficiency effects that are encountered "in the small;" that is, in the specific context of water policy reform. The following assessment of takings as it relates to integrated water policy reform will show that, in the specific context of water allocation, there arises an even richer variety of influences of public compensation on economic efficiency.

WATER POLICY REFORM AND THE EFFICIENCY EFFECTS OF COMPENSATION-IN-KIND

One of the key insights of this paper is that, in the context of a broad water policy reform where the takings provision would apply, both the quantum of damages and the form of compensation can be largely *endogenous* to the policy problem, and that the choice of each can have important efficiency effects. That is, some "optional" elements of a water policy reform package can have positive effects on the capital value of land, thereby reducing the magnitude of compensable damages, and, at the same time, can influence the efficiency of resource use. These points will be elaborated using the existing Alberta water policy as a benchmark.

Consider a landowner/irrigator in Alberta, Canada, who, under the existing water policy regime, has a "use permit" to draw up to some maximum annual volume of groundwater or surface water for irrigation use. That use permit has a number of characteristics that give it monetary value: (i) the permit essentially grants an appropriative right to use the water at negligible annual or marginal cost, although ownership of the water formally rests with the government; (ii) the permit remains valid for an indefinite term; (iii) the permit appertains to a specific property and is readily transferable *only* with the property, and only for the specified use; and, (iv) the permit has a certain seniority date that defines its relative priority to draw "all or none" of its maximum volume in times of shortage. At the same time, (v) the permit prohibits short term or long term transfers of water to other users or uses, either with or without remuneration; (vi) in an average year there is excess demand for water for irrigation use, and (vii) there are various expectations about the longevity of the current policy regime.

In such a system, the value of the water permit is capitalized into the value of the irrigable land to which it appertains, and the (private) present value of that permit could be estimated using either hedonic or contingent valuation methods. Some elements of a re-designed water policy could cause this capital value to decrease, and, were it in the U.S., could give rise to an "inverse condemnation" action, or claim for public compensation by a landowner due to a regulatory taking.⁴ At the same time, other elements of re-designed water policy could

increase the value of the water permit, and if present, could act as "non-monetary compensation" or "compensation-in-kind" that partially or fully compensates for any decrease. Finally, other elements of a new policy could be calibrated so as to increase or decrease this capital value, *ceteris paribus*.

Consider some examples from various aspects of water policy change, where (i) tradable permits; (ii) water pricing; (iii) groundwater and surface water access provisions; (iv) water banks and facilitative policies; and, (v) other integrated watershed management initiatives are considered in turn. The use of these instruments is described in Nichols (1992); Rosegrant and Binswanger (1993); Howe (1994); MacDonnell *et al.* (1994); and Tsur and Dinar (1995), among others. Each item could play a (calibrated) role in a "package" of water policy reforms.

(i) Tradable permits

A move to a system of tradable permits for water use that does not tie that water use to specific parcels of land might increase or decrease the capital value of the initial bundle of (water entitlements plus land). The magnitude of this change in value would depend on numerous other attributes of the tradable permits that are created. If capital appreciation results, it could be used either to offset capital losses due to other parts of the reform package, or to facilitate other socially desirable parts of the reform package that would otherwise give rise to compensable losses. Consider various of the attributes or characteristics that give the tradable permits value.

The term or duration of a permit will be a policy choice, as will the conditions for allocation in times of shortage or drought. Across jurisdictions, surface water entitlements are often (though not universally) issued with an indefinite term or duration, and groundwater permits are sometimes afforded guaranteed minimum use periods (Gisser, 1994:97). Alberta's system of seniority of rights provides one system of allocating in times of shortage, yet other alternatives include proportional rationing, or using pricing as a rationing mechanism. If the seniority system is to be maintained, rights which are traded could maintain their current seniority date, or their seniority could be reduced in some specified fashion.

A move to tradable rights might present an opportunity to reduce the stock of rights outstanding, such as by taxing back some portion of every reported trade. For example, proposed reforms in Alberta would have some form of "transfer reduction factor" that would allow authorities to reclaim (without specific compensation) ten percent of rights privately traded for reassignment to instream flow needs or for other higher valued uses. This feature would

potentially increase the efficiency of water use and could be accommodated without specific monetary compensation provided there are enough positive features of the reforms to prevent land values from falling.

Numerous features of new tradable rights that can potentially increase capital values and increase efficiency include increasing permit holders' flexibility to respond to changing water needs. Simplifying any registration and approval process for trades; enabling short term as well as long term (temporary versus permanent) trades; increasing the allowable distances over which one can trade; and allowing trades that involve a change of timing or intended purpose of water use would all qualify.⁵

Other, more institutional, features of new tradable permits might be under government control. Consider such examples as defining whether water trades are taxable supplies for the purposes of consumption taxes; whether the proceeds from such trades are taxable as income or capital gain; and whether the rights that are issued shall be treated as real property eligible for seizure or forfeiture by the courts or creditors. In the Alberta context, this might also include redefining the rights holders to be owners (rather than users) of water drawn under current entitlements.

(ii) Water pricing

Situations could arise where water pricing is used in addition to, or in place of, a system of tradable rights, and where such pricing promotes the efficient use of water. For example, systems of peak load pricing and priority pricing may serve as ways of rationing water in times of shortage, and may generate quantity allocations that dominate (on efficiency grounds) those resulting from allocation by seniority, for example. The design or reform of pricing policies could influence the nature of any compensation otherwise payable to landowners by government.

The market values of land and water will be influenced by the principles underlying the pricing system that is used, where historical approaches might include variants of marginal cost pricing, average cost pricing, or pricing with specific revenue-raising objectives. Prices for water use might also be subject to various market controls, such as minimum or maximum allowable prices. Some jurisdictions may also have the authority to introduce other capital levies and assessments, such as those related to capital and infrastructure investments. In Alberta, there are proposals to allow some, as yet unspecified, form of water prices or charges, which will in general contribute to any claim that the policy reform package represents a regulatory taking. In other jurisdictions with a history of water use charges, price reforms could diminish or offset such claims.

(iii) Groundwater and surface water access provisions

There may be a number of other features related to ground and surface water supply or access that fall under public control and whose reform could serve the dual purposes of efficiency enhancement and compensation-in-kind. Alberta, for example, maintains co-existing appropriative and riparian rights systems where some holders of appropriative rights might suffer future injury if increasing quantities of surface or groundwater are exploited by landowners exercising riparian rights. The conversion to a system based solely on appropriative rights could be efficiency enhancing and could represent a form of compensation-in-kind to existing holders of appropriative rights.

Depending on the rationing rules that will apply in times of shortage, holders of appropriative rights might benefit from reducing any policy uncertainty regarding future rights that might be issued. Governments could commit, however credibly, to some limited schedule of future changes to the rights regime in place and to a specific policy governing future expansions or contractions in the quantities of rights that will be outstanding. This might take the form of periodic policy reviews or sunset clauses. Equally important could be a legislative commitment requiring the government to acquire through purchase, any rights that public agencies might require for appropriative or instream flow uses of water, where the alternative policy might feature various forms of exemptions for public uses.

Users of water will be concerned about characteristics such as system reliability and water quality, where these will usually be beyond the individual's control. For groundwater users sharing an aquifer, there will be concern about water depth and water quality as reflected in whether and when a steady state rate of withdrawal is expected to be attained. Thus, for both surface and groundwater another way of providing efficiency-enhancing compensation-in-kind will be to improve system design and operation—including an enhanced regime of monitoring and enforcement—so that reliability and quality standards are improved or assured. This might include provision of some form of public insurance against users' losses due to "upstream" water system failure where this insurance is otherwise unavailable from private insurers.

Users will be influenced by any other provisions that influence their access to water under appropriative or riparian rights they hold. For example, much has been made of the way that some jurisdictions maintain a "beneficial use" provision of the "use-it-(properly)-or-lose-it" variety which may place in jeopardy the existing rights of any holders who would offer up rights for short term or long term reassignment.

Removing or re-writing these provisions can improve the efficiency of water use and decrease any other capital losses occasioned by water policy reform. Some jurisdictions might have various conservation standards in place that mandate or prohibit certain technologies, such as irrigation sprinkler efficiency or canal design and maintenance standards. Where these standards are made superfluous by other conservation-promoting features of the water quality reforms, their elimination might favor some individuals.

(iv) Water banks and other facilitative policies

If the move to a system of market-based water reallocations does not seem likely to generate a sufficient frequency or quantity of trades and reallocations of water, as may often be the case, there may be scope for establishing a privately or publicly operated market intermediary, operating as a water bank (Howe, 1994; MacDonnell *et al.*, 1994). There will be potential for a water bank to increase the value of rights by reducing the transactions costs faced by potential sellers and buyers, especially where immediacy is important or where there are relatively small volumes at stake. A related efficiency effect may come from providing water owners with an immediate source of short term financial liquidity when credit is otherwise constrained. There may be an added incentive for individuals to supply water when they see it as a solution to cash flow constraints.

With water banks, as with other forms of water organization and management, there will be some policy latitude for assigning legal and financial responsibility for operating these systems, including responsibility for costs associated with metering, monitoring, enforcement, and so on. Not all of the alternatives will be equivalent in their effect, where systems that impose broadly-based joint-and-several liability may decrease individual's willingness to participate or to bear these risks. Where these policies are expressed as laws and regulations, there will be scope for choosing the liabilities and penalties for misuse and overuse, and the procedures and forum for prosecuting such actions.

(v) Other integrated watershed management initiatives

There are a number of other components of a package of water policy reforms that are consistent with an integrated approach to management of the entire watershed, and which go beyond issues of surface or groundwater allocation *per se*. These include the allocation of water to hydroelectricity and petroleum industry users and uses; instream flows and wetlands needs; and water quality concerns such as salinity and wastewater management. Each will be discussed briefly.

Once one assumes a broader, watershed perspective on allocation issues, it becomes clear that there may be scope for beneficial changes in the interseasonal use of water, such as through changing the periods of hydroelectric reservoir storage and draw down in a given river system. Depending on the direction of the proposed changes, landowners who currently are allowed use of surface water for irrigation may receive a capital gain or loss from irrigation season supply changes. Where, as in Alberta, there is an active petroleum industry that uses surface and other waters for the purpose of enhanced oil recovery within specific watersheds, these uses and return flows can be made to fall within or beyond any set of policy reforms that is to be implemented. Following a more integrated or encompassing approach to the allocation of all such water might well provide gains to downstream users and offset other compensation requirements.

Any move to increase minimum flows for various instream needs may require restrictions on current upstream uses and may give rise to takings claims. The same may be true of new water assignments for wetlands and estuary maintenance, especially where these policy changes also restrict the other drainage and land use practices that adjoining landowners may employ. All the same, the allocation of water to these purposes may not represent high rates of consumptive use; that is, these uses may have high return flows which become available elsewhere in the system. There may be some "up side" to increased instream flows, such as increased quantities and improved reliability of surface flows for downstream users within the same jurisdiction. Increased upstream takings compensation and decreased downstream takings compensation may be largely offsetting.

Proposals are being considered and implemented for salinity management and wastewater recycling in jurisdictions other than Alberta, and these may eventually have some role in integrated watershed management in Alberta too. For example, a policy change that promotes trading of surface water and water permits might be paralleled by a system requiring a landowner to possess a (tradable) permit to discharge effluents with specific salt loads or concentrations (including irrigation runoff). Such a restriction on saline effluents might be seen as a regulatory taking by some users, depending on how it was implemented. All the same, another group, such as downstream urban and agricultural water users might be clear beneficiaries of such a policy package. The decision to restrict these saline discharges might prevent some other (compensable) decline in downstream land values.

In the case of wastewater recycling, such as for non-potable uses and for groundwater recharge, there is clear potential for the creation of water quantity gains for those who will have access to the new treated flows for

specific uses (McClurg, 1995). Similarly, there might be quality losses of some perceived degree for those who will continue to draw historical quantities from the water source that has been augmented. Under a takings regime there may be an extra incentive to introduce recycling programs of this type as part of a package of other reforms, provided they meet the test of enhancing economic efficiency. Once again, the water supplies made available may provide low-cost yet valuable compensation-in-kind where monetary compensation would otherwise be required.

CONCLUDING REMARKS

Two concluding observations follow from the foregoing. The first is that, in general, governments will also be interested in the equity, fairness, and distributional effects of the policy reforms they enact, where these have not received attention here.⁶ Whether or not the compensation requirement represented by the takings provision "improves" the distribution of income in a particular jurisdiction will depend on how that society views the prior distribution, and on whether the compensation provided over- or under-compensates for the wealth effects it causes. Recall that the compensation requirement is based on property values per parcel, where landowner income and welfare levels may change relatively more or less than property values.

The second observation is that each jurisdiction will have greater or fewer "degrees of freedom" to substitute efficiency-enhancing compensation-in-kind for the monetary compensation that it might otherwise have to provide as a result of pursuing water and resource policy reform. Presumably, those jurisdictions that do not have well developed water markets and institutions have the greatest latitude for exploiting such compensation-in-kind strategies, and at the same time might face some of the largest compensation liabilities since water policy changes and land values may be highly correlated. In a "nearly first-best" world, policy-makers will be in the position of having exploited nearly all of the efficiency-enhancing elements of a broadly-based water policy, and they will be approaching the optimum value of the relevant social objective function. Eventually, for them, monetary compensation will be the highest-valued (or least-cost) form of compensation at the margin, and its use will be recommended when water resources are to be reallocated.

What these examples illustrate is that policy designers will have, within bounds, the ability to choose what the net decrease (or increase) in capital values will be when undertaking broadly-based policy reform. Moreover, where liability for compensation does exist, there may be scope to provide it as efficiency-improving compensation-in-kind, as part of the policy package.

From the perspective of the affected landowners, and from the perspective of the policy makers with an efficiency objective, compensation, be it in cash or in-kind, may well serve as a catalyst to enacting policy changes that yield efficiency gains.

NOTES

* The author gratefully acknowledges financial support from Environment Canada through the University-Based Research Program on Economic Instruments. The views expressed here are not necessarily those of the Department of Environment Canada. Any errors or omissions are the author's alone.

¹ Innes' examination of recent cases focuses mainly on *Dolan v. City of Tigard* (U.S. S. Ct. No. 93-518, June 24, 1994); *Lucas v. South Carolina Coastal Council* (U.S. S. Ct. No. 91-453, June 29, 1992); and, *Nollan v. California Coastal Commission* (483 U.S. 825, 1987).

² There is ample Canadian precedent for public compensation to be offered to asset owners harmed by broadly based public policy change, even where that change would not represent a taking *per se*. Such compensation has been offered voluntarily by government even in a fiscal environment that features a renewed effort to reduce public deficits and debt. One recent example includes (voluntarily-enacted) Canadian federal government compensation to owners of western grain lands whose real property values have fallen due to the elimination of federal rail transportation subsidies. Another example is found in the Atlantic fishery, where numerous fishing vessels have been idled by the long term (federal) closure of various fisheries undertaken to preserve commercial fish stocks. In this instance, vessel owners who have suffered capital losses (manifest in the market values of boats and licences) are eligible to benefit from federal buy-back schemes for fishing licences, thus partly compensating and facilitating the owners' formal exit from the industry.

What is less clear is whether other Canadian agencies charged with water policy reform—agencies found mostly at the province level—would feel bound or constrained by such precedents or tradition to provide compensation if proposed water policy reform were expected to reduce land values.

³ Market values may change more or less than the private valuations of the current landowners, due to differences in expectations about prices and technology, and due to differences in such factors as discount rates and marginal tax rates, for example.

⁴ Of course, the absence of a takings clause in Canada could be responsible for current under investment as the markets await the specific details of promised reforms.

⁵ One prerequisite to allowing such flexibility would be the redefinition of water rights to represent net or consumptive usage (gross water withdrawals—over which Alberta use permits are currently defined—minus estimated return flows), where only the net portion is tradable. This reduces any direct harm that might be caused by the trades to third parties who rely on the return flows to local groundwater or surface watercourses.

⁶ There may be separate societal concerns for procedural fairness as well as for fairness of the resulting income or welfare levels. Presumably the former concerns would align more closely with requiring full compensation for regulatory takings than would the latter.

REFERENCES

- Blume, Lawrence and Daniel L. Rubinfeld. 1987. "Compensation for Takings: An Economic Analysis," in Austin J. Jaffe (ed.) *The Economics of Urban Property Rights*, Research in Law and Economics series, Volume 10 (Greenwich, CT: JAI Press Inc.) 53-104.
- Farber, Daniel A. June 1992 "Economic Analysis and Just Compensation," *International Review of Law and Economics*, 12(2): 125-138.
- Gisser, Micha. 1994. "The Appropriation Doctrine: A Tool for Continental Water Marketing Along the U.S.-Mexico Border," Chapter 6 in Terry L. Anderson (ed.) *Continental Water Marketing* (San Francisco: Pacific Research Institute for Public Policy), 93-111.
- Howe, Charles W. January 1994. "The Theory and Operation of Water Banks as a Water Allocation Mechanism," Mimeo. (Boulder, CO: The University of Colorado Law School, Natural Resources Law Center).
- Innes, Robert. First Quarter 1995. "An Essay on Takings: Concepts and Issues," *Choices*, 10(1): 4-7, and 42-44.
- MacDonnell, Lawrence J., Charles W. Howe, Kathleen A. Miller, Teresa A. Rice, and Sarah F. Bates. August 1994. *Water Banking in the West*, Research Report No. 12 (Boulder, CO: The University of Colorado Law School, Natural Resources Law Center).

McClurg, Sue. January/February 1995. "Water Recycling," *Western Water*, 4-13.

Nichols, Albert L. February 1992. *Tradable Permits for Water Use: An Overview of Concepts and Experience*, Prepared for TransAlta Utilities (Cambridge, MA: National Economic Research Associates, Inc.).

Rose-Ackerman, Susan. 1992. "Constitutional Law: Regulatory Takings," Chapter 9 in Susan Rose-Ackerman, *Rethinking the Progressive Agenda: The Reform of the American Regulatory State* (New York: Macmillan, Free Press), 132-143.

Rosegrant, Mark W. and Hans P. Binswanger. May 1993. "Markets in Tradable Water Rights: Potential for Efficiency Gains in Developing-Country Irrigation," Mimeo. (Washington: International Food Policy Research Institute).

Shabman, Leonard and David White. 1995. "Understanding Federal Taking Legislation," Paper presented to the 1995 Association of Environmental and Resource Economists Workshop, June 1995, Annapolis, Maryland.

Tsur, Yacov and Ariel Dinar. May 1995. "Efficiency and Equity Considerations in Pricing and Allocating Irrigation Water," Policy Research Working Paper 1460. (Washington: The World Bank, Agriculture and Natural Resources Department).

Theodore M. Horbulyk is an associate professor of economics at The University of Calgary in Alberta, Canada. His teaching and research interests include public economics, agricultural and resource economics, cost-benefit analysis and public policy. Professor Horbulyk holds Ph.D. and M.A. degrees in economics from Queen's University, Kingston, and a B.Sc.(Agr.) in agricultural economics from the University of British Columbia. Horbulyk is a co-editor of the Canadian Journal of Agricultural Economics and is a 1995 recipient of the Soil and Water Conservation Society's Berg Fellowship in Conservation Policy.